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(54) **HIGH SENSITIVITY ATOMIC
MAGNETOMETER AND METHODS FOR
USING SAME**

(75) Inventors: **Michael Romalis**, Princeton, NJ (US);
Tom Kornack, Washington, DC (US);
Joel Allred, Seattle, WA (US); **Rob
Lyman**, Charlottesville, VA (US);
Ioannis Kominis, Athens (GR)

(73) Assignees: **Trustees of Princeton University**,
Princeton, NJ (US); **University of
Washington**, Seattle, WA (US)

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(58) **Field of Classification Search** 324/304,
324/301, 300, 318, 322
See application file for complete search history.

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Primary Examiner—Louis Arana

(74) *Attorney, Agent, or Firm*—Proteus Patent Practice;
Henry E. Auer

(57) **ABSTRACT**

The present invention provides a high sensitivity atomic
magnetometer and methods of measuring low intensity
magnetic fields that relate to the use of an alkali metal vapor
and a buffer gas; increasing the magnetic polarization of the
alkali metal vapor thereby increasing the sensitivity of the
alkali metal vapor to a low intensity magnetic field; probing
the magnetic polarization of the alkali metal vapor, the
probing means providing an output from the alkali metal
vapor, the output including characteristics related to the low
intensity magnetic field; and measuring means that receives
the output, determines the characteristics of the low intensity
magnetic field, and provides a representation of the low
intensity magnetic field. In addition, the invention relates to
a magnetometer and methods that provide a representation of
a first magnetic field originating within a sample volume.
The sample volume may be part or all of a subject, such as
a human subject. The representation includes a representa-
tion of a source of a magnetic field occurring within the
sample volume displayed in one, two, or three of three
orthogonal Cartesian coordinates, referenced to the sample
volume.

94 Claims, 12 Drawing Sheets

